

# MATH, SCIENCE & TECH EDUCATION as part of 21<sup>ST</sup> Century Skills



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Summit on Math, Science & Technology Education – November 11, 2005

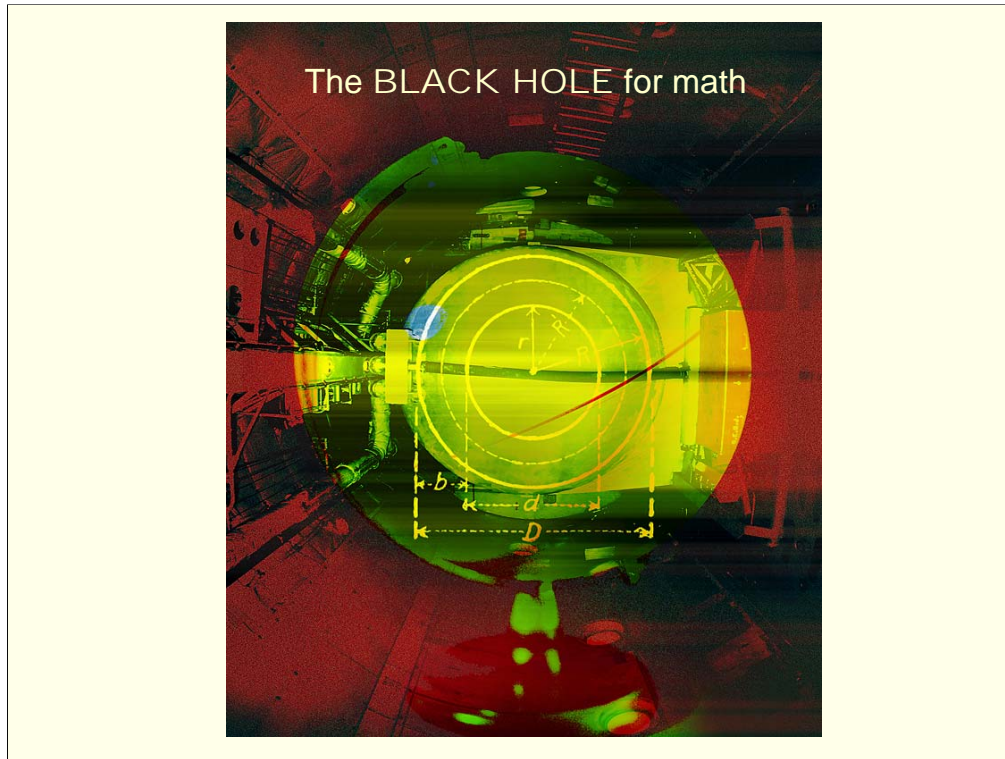


## Then and Now

### **Math, science and technology**

- **What to teach**
- **How to teach it**
- **How much is enough?**

- Improving the math, science and technology skills of our students started long before Sputnik.
- Concept of proficiency heightened by NCLB.
- Expected that all students can and should learn.
- Have simply not expected enough of all of our students in science and mathematics.



- I talked with over 1,400 individuals engaged in public education last spring, specifically at the high school level.
- Clear that we in Iowa have succumbed to the same trend that occurs across this nation- simply don't believe that all of our students are capable of doing extremely well in mathematics.
- For our students and families who have had clear goals on entering high school – who knew that we would and were expected to attend a 4 year institution – those students have been taking 4 or even 5 years of math and science by doubling up or starting in 8th grade.
- But for many others, the last year of a math or science course was sophomore year.
- We have expected more of our students in science at the high school level – graduation requirements have stipulated certain science courses. In math it is customary to require 2 years but students may choose or be tracked into non-rigorous courses.
- It is clear that in our culture, in our country, in our state, that while we expect all students to be able to read, we simply have allowed math phobia to permeate our thinking. Think about how we simply accept the statement, "I'm not good at math," or – "Mom and Dad weren't good at math either."



## Demand for better skills

- Digital society
  - Knowledge of technology
  - Ability to adapt and change
- More careers include technology
  - Even traditional “manual” labor
- Marketplace has no boundaries
  - For products
  - For employees

The role of technology and the pace of information have changed our world forever

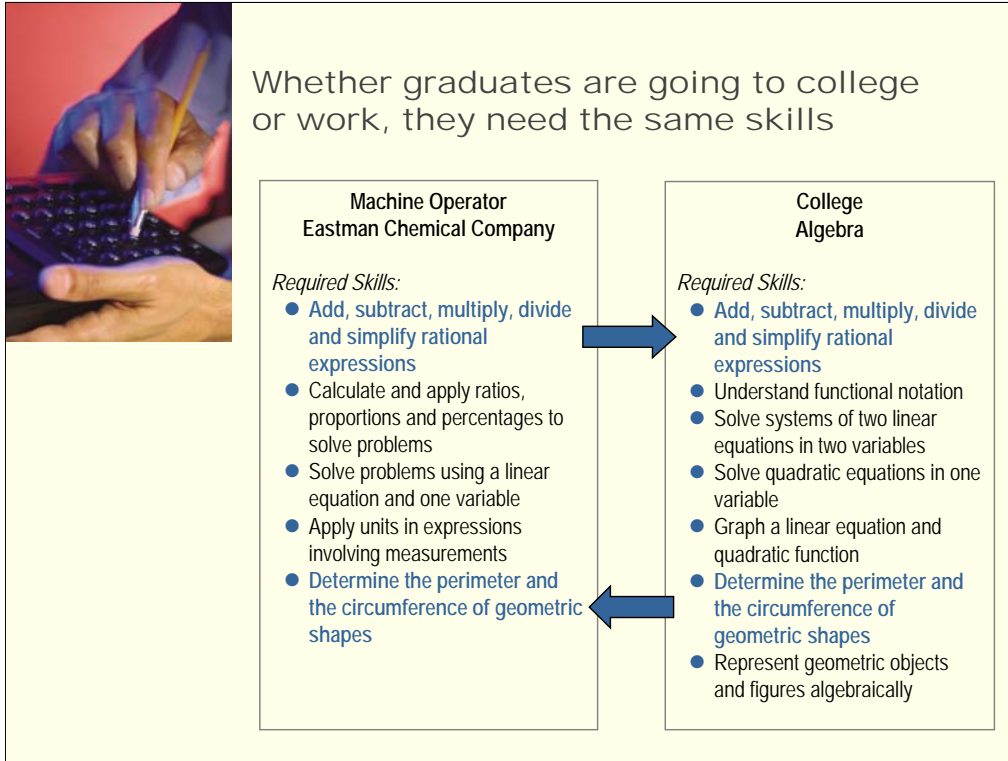
Challenges of the “digital society” are not keeping up with technology but anticipating the pace at which technology generates change.

- Our world is no longer predictable or familiar; jobs require constant adjustment.
- “Globalized” economy is much more competitive and demands higher skills from all workers.
- Technology is eliminating or redefining jobs. Low-skills jobs are now becoming knowledge jobs that require technical training, high-level academics and higher level thinking and problem-solving.
- Technology is reorganizing the work environments that demand multi-task workers with adaptable skills and increased responsibility.
- No longer is a worker deemed forever to one function – but to a work life that will be multi-faceted with broader skills required.



## Meeting the demands of today's jobs.

- America Diploma Project studied the entry-level requirements of jobs - found that these entry-level jobs require skills that we simply have not expected of all of our students - need to understand numerical operations, have a working knowledge of algebra, geometry, data interpretation, and statistics.
- Project compared what employers expect of college-level graduates and entry-level jobs - found that the skills expected were similar. A worker of today and tomorrow is placed routinely into situations where they must solve non-routine, multi-step problems. They must be able to analyze a situation, figure out the cause and the effect, and craft solutions.



- Another major finding from the ADP research was that high school graduates who go to college or directly into the workforce need the same knowledge and skills.



## Students Agree

**40%** Say they weren't adequately prepared.

**80%** Wish they'd worked harder.

- The American Diploma Project also surveyed recent high school graduates.
- Must increase expectations for all students.
- Must make the coursework meaningful and provide experiences for application into new contexts.
  - Learning must be seen as relevant.
  - How* to think & *how* to apply that knowledge in a variety of circumstances setting the foundation for lifelong learning.



Stronger Students = Stronger Economy



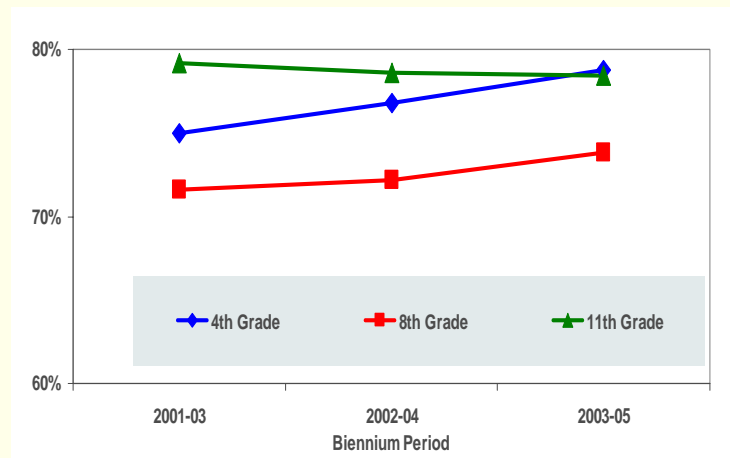
- Students of today exposed to new ways of learning and interacting with technology at home.
- 3.5% of Iowa's gross product comes from agriculture and that 20% comes from manufacturing and another 10% from finance and insurance.
- Iowa has a very ambitious and promising economic plan that focuses on high-wage, high-growth industry cluster areas, including biosciences, advanced manufacturing and information and financial services.





- Our nation is facing some of the same challenges as Iowa.
- World is catching up with us.
- The developing nations have more younger workers who have increasing literacy and math and science skills, the nations are increasing their post-secondary opportunities and thus their emerging young workers are educated and skilled. The market impacts us directly because developing nations now have greater productivity, (US share of world output was 40% - is now 21%) they are increasing quality products and moving rapidly into innovation (US industrial patents were at a high of 61% - now at 29%).
- Although job growth is expanding, it is not in low skilled jobs – 12% growth expected to drop to 2% – it is in skilled labor that will require some level of postsecondary education.
- Must work to actually have students graduate from postsecondary – whether it is with a 2 year degree, a certificate or a 4 year degree.
- Must also have jobs and promote Iowa as a place to live for our emerging graduates.
- Iowa has a negative migration rate of 220%, with more young, educated, single people leaving the state than entering. We're second in the nation with that statistic.
- Not just about the economic imperative though.
- The information age has bombarded our students with complex situations and a huge blitz of facts and opinions. Making sense of our world has never been so crucial. Think about how frequently you must use some of the basic concepts of statistics and probability as you filter and analyze. When we teach mathematics and science in ways that our students learn in depth and are able to apply what they have learned, we are also teaching students to solve problems, collaborate, reason, have strategies to address complex situations and create team players. These are skills valued by employers in the workplace.
- Raising graduation requirements – right to do but must also do it the right way.
  - Right courses, right content, right career pathway.
  - Integrate communication and literacy skills.
  - read technical materials.
- The workplace that students will enter does not have separate cubicles for writing, speaking, listening, and geometry. Teachers of today must consider themselves responsible for all of the necessary habits and skills of our students. Employers will expect data analysis, statistical process control, analytical skills, good work ethics, self-directed learners, flexibility, and good people skills.

## Trend for Math by Grade

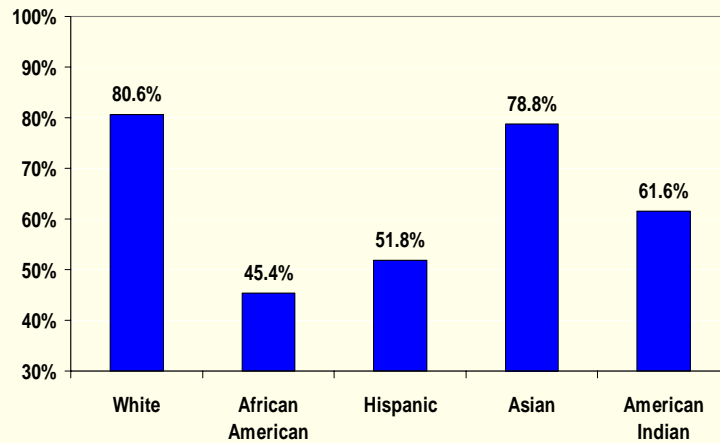


Iowa tests this past year

NAEP scores

- The average math score at 8<sup>th</sup> grade was higher than in 1990 but was not significantly different from the last testing period in 2003.
- Pay attention to the concepts that are tested by NAEP - standard that will be used for comparison of the quality of our Iowa system compared to others.

## Grade 11 Math by Race/Ethnicity



In math, performance is up for African American and Hispanic students in grades 4 and 8, and up slightly for African American in grade 11.

- Gaps at all grade levels are significant.

- Science:

- 8<sup>th</sup> grade 79% are proficient
- 11<sup>th</sup> grade on the ITED approximately 80% of our students are proficient

- BUT – the achievement gaps persist.....



To improve math, science and technology learning, we must:

- Increase expectations for ALL.
- Required rigorous curriculum
- Restructured curriculum that is meaningful and relevant.
- Integrated and articulated across K-16.
- Link to Iowa's economic opportunities.

Although our students achieve well overall, we cannot be satisfied – especially with the achievement of our students who are struggling.



## To improve math, science and technology learning, we must:

- Increase expectations for ALL.
  - Standards
  - Assessments
- Required rigorous curriculum.
  - Meaningful, relevant
  - Course-taking patterns
- Quality teacher in every classroom
- Link to Iowa's economy.
  - Community partners
  - Employers

### Where do we go from here?

#### 1. High expectations for all students

Standards - not too many but the right ones.

Assessment of student learning – matched to the expectations – what do teachers need on a regular basis to adjust instruction.

#### 2. Restructure curriculum delivery

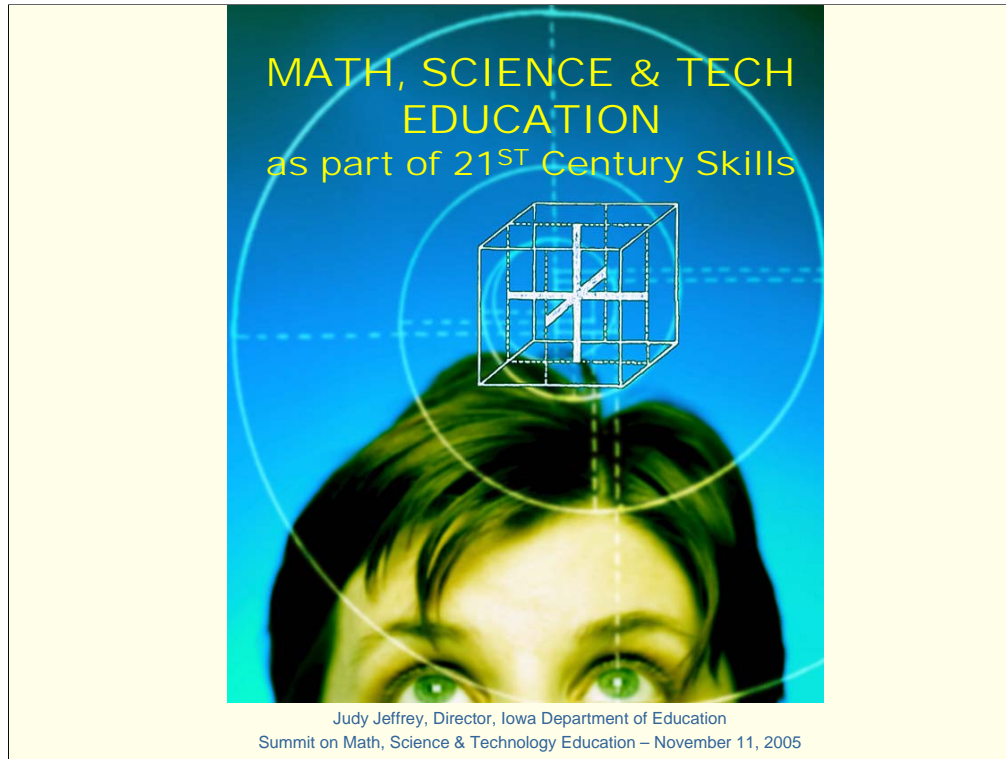
- Required rigorous integrated for all students
- Examine the course-taking patterns

#### 3. Quality teacher in every classroom

- Understanding of how math and science work – content but the pedagogy. Decisions about how to teach are best made on the basis of the particular content, the learning goals, and the student's previous knowledge and skill.
- Recruit teachers – it starts early – facing real shortages – without a teacher we simply cannot expect our students to be better. “Over a quarter-million math and science teachers are needed...That is like a ticking time bomb not just for technology companies, but for business and the U.S. economy.” Stanley Litow, IBM Foundation Head
- Need the most up to date instructional tools available – most students have these tools at home – we must have our teachers proficient in the use and have the tools available.

#### 4. Need partners in this work

- First, the community – have a major sell effort on our hands.



#### Conclusion:

Our world of today is demanding more – our students can learn better and faster – that doesn't necessarily mean more but deeper understandings and more relevancy in their work. It means a stronger course taking pattern for all – it means making sure that all students have the math and science knowledge and skills needed for today's world, regardless of the career path they choose – it means all teachers having the skills and resources they need to teach – it means creating the public will to change – it means that America will meet the productivity demands and the security challenges it faces because our students will be better equipped to handle the demands they will face.